Lecture Notes in Computer Science 11404

Commenced Publication in 1973
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Computational Methods and Clinical Applications in Musculoskeletal Imaging

6th International Workshop, MSKI 2018
Held in Conjunction with MICCAI 2018
Granada, Spain, September 16, 2018
Revised Selected Papers

Springer

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ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-11165-6 ISBN 978-3-030-11166-3 (eBook)
https://doi.org/10.1007/978-3-030-11166-3

Library of Congress Control Number: 2018966327

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

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Preface

The musculoskeletal system consists of the skeleton, muscles, cartilage, ligaments, joints, and other connective tissue that supports and binds tissues and organs together, and provides form, support, protection, stability, and movement to the body. Specific subsystems like the spine provide both a vital central axis for the musculoskeletal system and a flexible protective shell surrounding the most important neural pathway in the body, the spinal cord. The musculoskeletal system is involved in various disease processes associated with aging and degeneration of bones and joints, such as osteoporosis and osteoarthritis. Osteoporosis is a condition where bones become brittle and fragile from loss of tissue due to hormonal changes, or deficiency in calcium or vitamin D. Osteoporosis leads to an increased bone fracture risk, which is further exacerbated in the elderly owing to the loss of muscular strength and frailty. Osteoarthritis, or degenerative arthritis, is caused by inflammation and the eventual loss of cartilage in the joints, which wears down with time. These are just a few relevant examples of the conditions associated with the musculoskeletal system, not to mention therapeutic procedures in orthopedic surgery, and the related medical implants and devices where imaging plays a crucial role in the planning, guidance, and monitoring phases. As a specialty of diagnostic radiology, musculoskeletal imaging involves the acquisition, analysis, and interpretation of medical images of bones, joints, and associated soft tissues for injury and disease diagnosis and treatment. Given the increasing volume of multimodal imaging examinations associated with musculoskeletal diseases and the complexity of their assessment, there is a pressing need for advanced computational methods that support diagnosis, therapy planning, and interventional guidance, with several related challenges in both methodology and clinical applications.

The goal of the workshop series on Computational Methods and Clinical Applications in Musculoskeletal Imaging is to bring together clinicians, researchers, and industrial vendors in musculoskeletal imaging for reviewing the state-of-the-art techniques, sharing novel and emerging analysis and visualization techniques, and discussing the clinical challenges and open problems in this field. Topics of interest include all major aspects of musculoskeletal imaging, for example: clinical applications of musculoskeletal computational imaging; computer-aided detection and diagnosis of conditions of the bones, muscles, and joints; image-guided musculoskeletal surgery and interventions; image-based assessment and monitoring of surgical and pharmacological treatment; segmentation, registration, detection, localization, and visualization of the musculoskeletal anatomy; statistical and geometrical modeling of the musculoskeletal shape and appearance; image-based microstructural characterization of musculoskeletal tissue; novel techniques for musculoskeletal imaging.

The 6th Workshop on Computational Methods and Clinical Applications in Musculoskeletal Imaging, MICCAI-MSKI2018[1], was a half-day satellite event of the 21st International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2018[2], held during September 16–20, 2018, in Granada, Spain. The workshop was a continuation of the former Workshop on Computational Methods and Clinical Applications for Spine Imaging, CSI, which was, after four successful consecutive editions at MICCAI 2013, 2014, 2015, and 2016, opened up within its MICCAI-MSKI2017 edition to a wider community by broadening the scope from spine to musculoskeletal imaging, thereby recognizing the progress made in spine imaging and the emerging needs in imaging of other bones, joints, and muscles of the musculoskeletal system that was continued also in this year within MICCAI-MSKI 2018. We received several high-quality submissions addressing many of the aforementioned issues. All papers underwent a double-blind review, with each paper being reviewed by three members of the Review Committee. We finally accepted 13 out of 16 submitted papers, which were collected in soft-copy electronic proceedings distributed at the workshop and during the conference.

MICCAI-MSKI2018 was held on September 16, 2018, with the program consisting of three oral sessions: (1) Muscles and Bone Structures (three presentations), (2) Teeth, Wrist, Shoulder, and Ribs (four presentations), and (3) Hip and Pelvis (six presentations). To gain deeper insight into the field of musculoskeletal imaging and stimulating further ideas, an invited talk entitled "Multidisciplinary Computational Anatomy Modeling of Musculoskeletal Structures and Total Hip Arthroplasty from Medical Images" was given by Dr. Yoshinobu Sato from the Nara Institute of Science and Technology, Japan. The members of the Organizing Committee selected one outstanding contribution for the MICCAI-MSKI2018 Best Paper Award, which was given to the paper entitled "Deep Learning Based Rib Centerline Extraction and Labeling" by Matthias Lenga et al. from Philips Research Europe, Germany. After the workshop, the authors were invited to revise and resubmit their papers by considering the comments of the reviewers and the eventual feedback from the workshop itself, to be considered for publication in Springer's *Lecture Notes in Computer Science* (LNCS) series. The authors of all 13 papers presented at the workshop responded to the call, and after reviewing the resubmitted papers, the members of the Organizing Committee agreed that the revisions were of adequate quality, thus the papers now appear, in the chronological order of the initial submission, in these LNCS proceedings.

We would like to thank everyone who contributed to this workshop: the authors for their contributions, the members of the Program and Review Committee for their review work, promotion of the workshop, and general support, the invited speaker for sharing his expertise and knowledge, and the MICCAI Society for the opportunity to

[1] https://mski2018.wordpress.com.

[2] https://www.miccai2018.org.

exchange research ideas and build the community during the premier conference in medical imaging. Finally, we would like to invite the community to support the MSKI workshop in its future editions.

December 2018

Tomaž Vrtovec
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